Mac OS X and Scientific Computing

Session 606

These are confidential sessions—please refrain from filming or taking pictures.

Enterprise IT

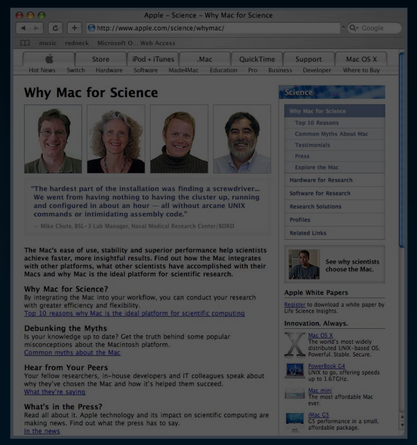
Mac OS X and Scientific Computing

Bud Tribble M.D., Ph.D
VP Software Technology

http://developer.apple.com/wwdc2005/

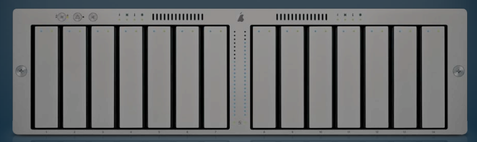
iMac G5 17″ &
20″ at 1.8GHz

Aug 31 2004



Why Mac for
Science Program

Oct 2004



Xserve RAID 5.6TB

Oct 19 2004

Society for
Neuroscience
2004

Oct 2004

The MathWorks
MATLAB DCE

INCOGEN
VIBE

UNITED DEVICES™
Grid MP

Key Product
Launch

Nov 2004

NATIONAL INSTRUMENTS

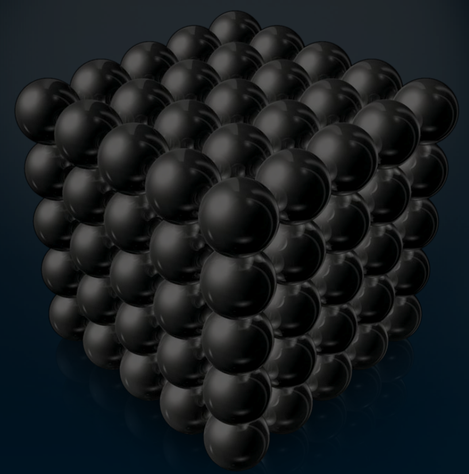
M-Series

NIDAQ

USB Devices

Key Product Launch

Jan 1 2005

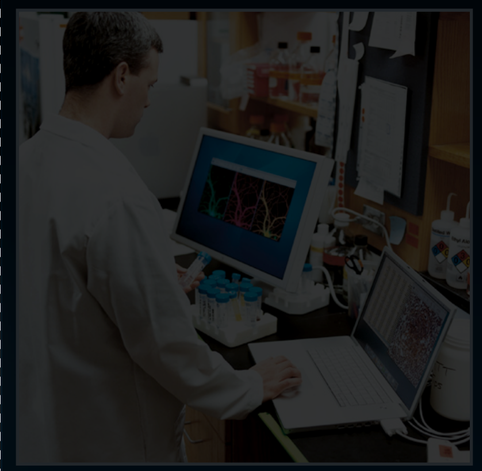


Xsan: SAN File Systems for Mac OS X

Jan 1 2005

Mac Mini: Introducing Mac to Many New Users

Jan 11 2005



PB G4 1.67GHz: Portable Research Workstation

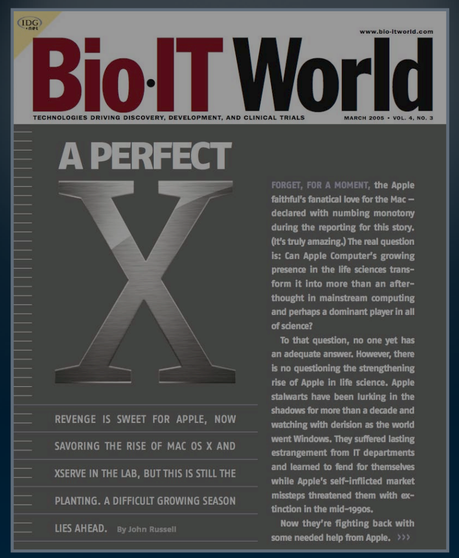
Jan 31 2005

biotrue

CDMS

Key Product Launch

Feb 2005



Apple Makes buzz in Biotech

Mar 2005

GOLDEN HELIX

ChemTree HelixTree

axiope

Catalyzer

Hypercube, Inc.

HyperChem

Key Product Launch

Mar 2005

American Chemical Society 2005

Mar 2005

AACR

American Association for Cancer Research

American Association for Cancer Research 2005

Apr 2005

Molecular Imaging

Toolkit

amira | 3.1

open inventor FROM MERCURY 5.0

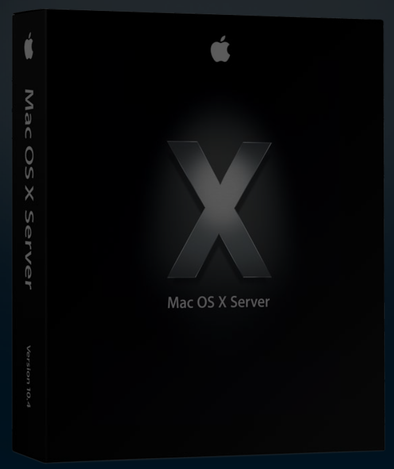
Drug Development

Key Product Launch

Apr 2005

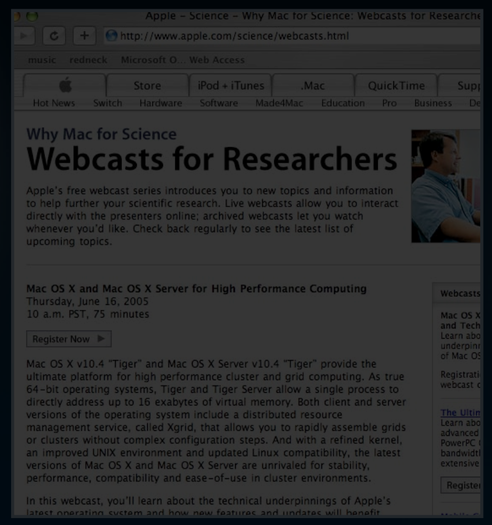
PowerMac G5
2.7GHz

Apr 27 2005



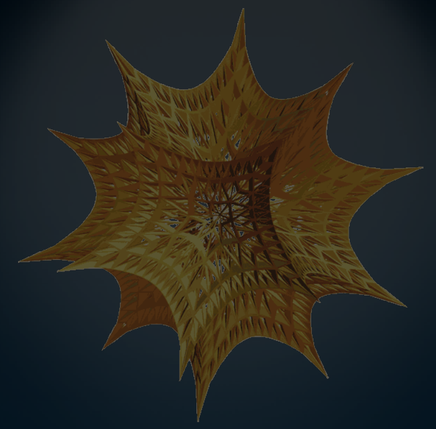
Mac OS X: Tiger
Empowering
Science

Apr 29 2005



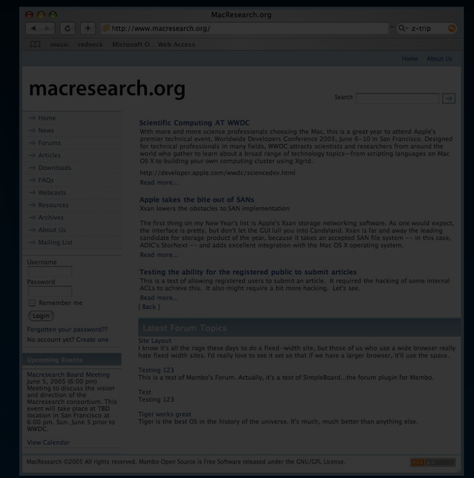
Science Webcasts

May 2005



Wolfram's 64 bit
Mathematica

Jun 2005



macresearch.org

Jun 2 2005

“In research life sciences-probably 50–70% of research laboratories used Macs. It’s by far the most common analysis platform”

Mario Roederer,
Stanford University

UCLA Medical School

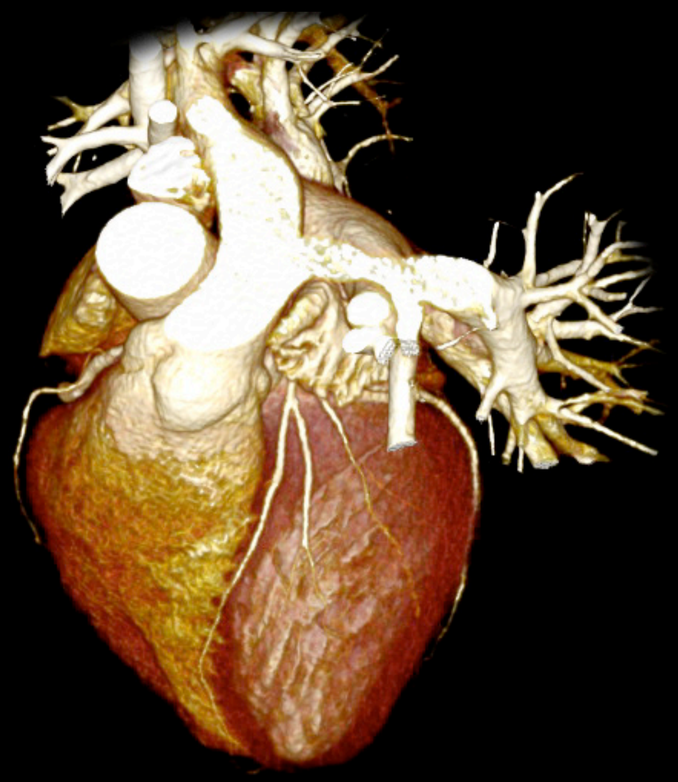
OsiriX Medical Image Analysis and Collaboration

Dr. Osman Ratib
Professor and Vice Chair UCLA Radiology

http://developer.apple.com/wwdc2005/

What is OsiriX

- 3D and 4D Viewer for Medical Images
- Open Source Cocoa project
- Developed by physicians for physicians
- Already used by thousands of Radiologists and researchers worldwide
- Meeting the high-end demands in Medicine with Mac OS X technologies
- Facilitates collaboration and communication in healthcare



Challenges of the Medical Professional

- Review and analysis of very large data sets for clinical decision support
- Collaboration w/Patients and Referring Physicians
- Performance in Advanced Image Processing and Analysis
- Dynamic 3D visualization supporting diagnostic and therapeutic procedures
- Automation for timed tasks for higher performance and better patient care
- Extremely High Data Quality and Large Data Sets

Technology Adoption to Add Value

Quicktime 3D

iCal Scripting

Mail.app

iPod/iPhoto

64 bit

CoreData

Xgrid

vecLib, OpenGL, Quartz Extreme AltiVec Optimizations

.Mac/iDisk

iChat AV Collaboration

OsiriX Demo

Dr. Antoine Rosset

http://developer.apple.com/wwdc2005/

Wolfram Research
64 Bit Mathematica on Mac OS X

Rob Raguet-Schofield
Software Engineer
Wolfram Research, Inc.
schofield@wolfram.com

http://developer.apple.com/wwdc2005/

Mathematica 5.2

- Capabilities
  - Calculator (Symbolics, Numerics, Graphics)
  - Language (Functional, Procedural, Object Oriented)
  - Word Processor (Typeset Formulas, Graphics)
- Background
  - 1.0 for Macintosh in 1988
  - “Mac” UI with “Unix” Core
  - Mac OS X is ideal platform for Mathematica
  - Incorporates many great Mac OS X technologies
  - Will incorporate new technologies as they become available

Challenges of Technical Computing

- Computing
  - Running interactive computations
  - Utilizing sophisticated algorithms
  - Distributing parallel tasks across a grid
- Analyzing
  - Exploring data in an intuitive environment
  - Working with large data sets
  - Working with numerous data sets
- Visualizing
  - Visualizing complex results
  - Publishing results

Technology Adoption to Add Value

altivec

Aqua UI

64 Bit

Java

OpenGL

Spotlight

Automator

64-bit vs. 32-bit Arbitrary Precision Mathematics

Demo
Mathematica 5.2 on Mac OS X Tiger

http://developer.apple.com/wwdc2005/

Dauger Research

Pooch: "Plug-and-Play" Clusters on Mac OS X

Dr. Dean Dauger
President

http://developer.apple.com/wwdc2005/

What is Pooch

- Pooch manages clusters of network-connected Macs
  - Supports supercumputer-compatible calculations
- Important Pooch features
  - MPI, Accessible to users, Plug-n-Play
- Typical Pooch users
  - All disciplines Academic, Government, Industry

“Plug-and-Play” Clusters on Mac OS X

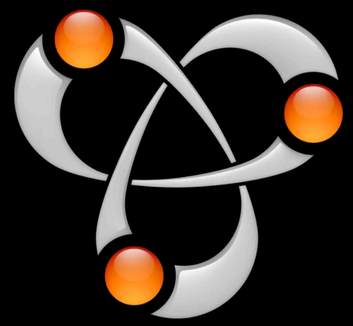
- Pooch App—Reinventing the Cluster Computer
  - Supports 5 MPI’s with zero OS modifications
  - Dynamic utility for managing Mac-style parallel applications
  - Queries nodes discovered using Bonjour (’02) and SLP
  - Interactive diagnostics for development and optimization
  - Designed to bring HPC to the mainstream user
  - Independence of NFS, rsh, ssh, static data, CLI ⇒ reliability
- Lowest “barrier to entry” ⇒ saves time and money
- Enables users to focus on getting useful work done!

Challenges of High-Performance Clusters

- Tackling problems too large to solve on one computer
  - Takes too much time
  - Requires more memory
- Previous cluster types are fragile
  - Can take weeks to assemble (except for experts)
  - Failures common and fatal to system—hard to diagnose
  - Requires high-end skill set, even to maintain
- Previous cluster types are hard to use
  - Put together with no attention to usability or accessibility
  - Requires complex configuration using arcane commands
  - Users forced to be responsible for fixing hw/sw/os bugs

Technology Adoption to Add Value

Spotlight

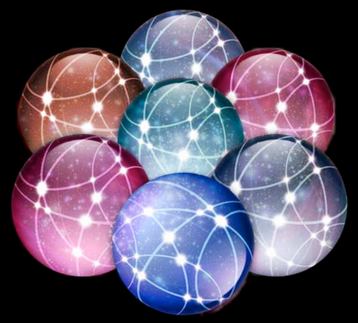


Bonjour

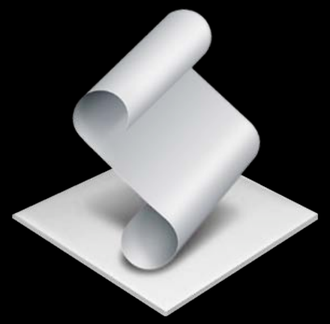
Automator

MPI

MPI Support



Xgrid



AppleScript

Dashboard

The Mac Cluster Recipe

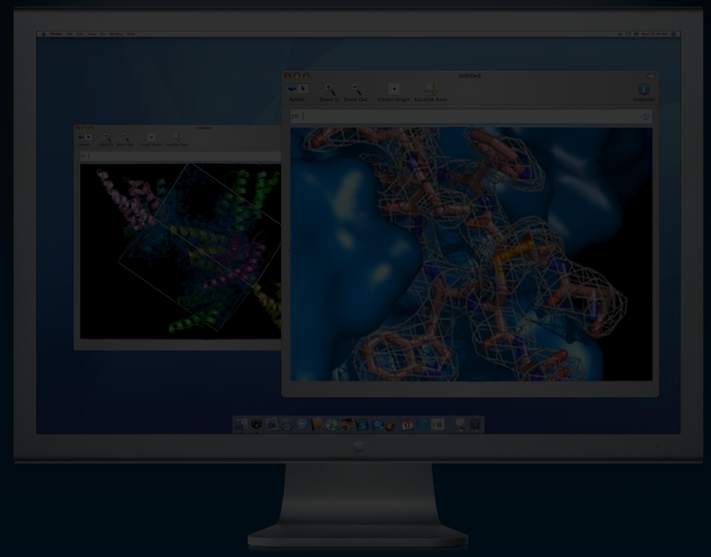
- Ingredients
  - Power Macintosh or Xserve G4s or G5s
  - Fast Ethernet switch (or faster)
  - Ethernet cables
- Directions
  - Connect cables from Macs to switch
  - Download Pooch (→ daugerresearch.com/pooch/)
  - Install Pooch—in seconds per node!

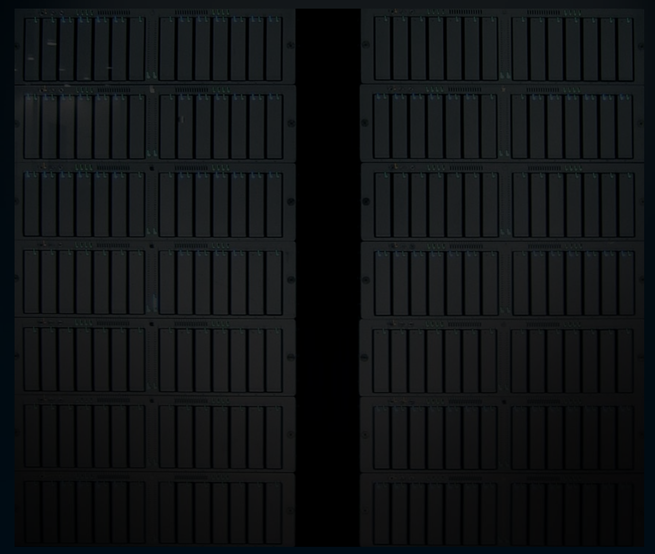
Demo
Pooch Clustering on Mac OS X

http://developer.apple.com/wwdc2005/

Get Ahead of the Curve

http://developer.apple.com/wwdc2005/





Really Big Computing | **Really Big Visuals** | **Really Big Storage**

Science @ WWDC 2005

- Science Connection—Tues-Fri Room 3014
- Science Discussions—12:30-2pm Tues-Fri in Science Connection
  - Tues—Data Acquisition and Management
  - Wed—HPC in the Sciences
  - Thur—Scientific and Medical Imaging on Mac OS X
  - Fri—Science Feedback Roundtable
- Apple Design Awards—Best Scientific Computing Solution
- BioCocoa Group Mtg—Wednesday 6:30pm in the Science Connection
- Many sessions and labs relevant to creating great science apps

Session Schedule

Related session **Building 64 bit Solutions for Tiger**	**Session 507** **Wed 2:00pm SOMA**
Related session **Extending your applications to run on an Intel-based Macintosh**	**Session 103** **Wed 5:00pm Presidio**
Related session **Dashboard Widgets**	**Session 114** **Wed 10:30am Presidio**
Related session **Advanced Dashboard Widgets**	**Session 134** **Thu 2:00pm North Beach**
Related session **Performance and Graphics Tuning Your Java Application**	**Session 632** **Fri 9:00am Nob Hill**
Related session **Develop, Debug, Deploy Java Applications on Mac OS X Tiger**	**Session 624** **Thu 9:00am Marina**
Related session **JNI Development on Mac OS X**	**Session 631** **Thu 3:30pm Mission**
Related session **Moving from QuickDraw to Quartz 2D**	**Session 215** **Fri 9:00am Presidio**
Related session **Optimial 2D Application Graphics**	**Session 216** **Fri 10:30am Presidio**

Related session **Performance Analysis of Your Memory Code**	**Session 409** **Fri 3:30pm Marina**
Related session **Code with Apple's Image and Signal Processing API's for Maximum Performance**	**Session** **Fri 10:30am Mission**
Related session **Swimming with Shark**	**Session 407** **Fri 2:00pm Presidio**
Related session **Threading on Mac OS X**	**Session 124** **Wed 5:00pm Nob Hill**
Related session **Power Programming with Xcode**	**Session 403** **Wed 5:00pm SOMA**
Related session **Core OS Enhancements for BSD Developers**	**Session 510** **Thu 3:30pm North Beach**
Related session **Applescript for C, C++ & Java Programmers**	**Session 138** **Thu 3:30pm Marina**
Related session **Customizing Mac OS X Using Open Source**	**Session 508** **Wed 3:30pm Marina**

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WWDC2005

Worldwide Developers Conference